STATOR STRUCTURE OF ROTARY DEVICE AND ITS FORMING METHOD

FIELD OF THE INVENTION

The present invention is related to a stator structure of a rotary device and its forming method, and particularly to a stator structure of a motor and its forming method.

BACKGROUND OF THE INVENTION

Please refer to Fig. 1A showing a conventional motor fan 1 which includes a stator 11, a rotor including a ring-type magnet 12 and a hub 14 having a plurality of blades circumferentially fixed on its surface, a printed circuit board 13, and a fan guard 15. The stator 11 is formed by disposing a silicon steel sheet 111 with a specific shape in the mold to be sheathed with an insulator 112 (that is, a potting process) for fabricating a bobbin on which a coil 113 is wound, as shown in Figs. 1A ~ 1C.

However, the surface of the silicon steel sheet 111 will be easily damaged due to high temperature during the potting process and the silicon steel sheet 111 will be easily covered with rust.

SUMMARY OF THE INVENTION

An object of the present invention is to provide a stator structure of a rotary device and its forming method.

According to the present invention, the method for forming a stator structure includes the steps of (a) forming a first part having a first middle portion with a through hole, and M pieces of extending portions extending from the first middle portion, (b) forming a second part having a second middle portion with a through hole, and N pieces of

extending portions extending from the second middle portion, (c) alternately bending the M pieces of extending portions of the first part toward a first direction and alternately bending the N pieces of extending portions of the second part toward a second direction opposite to the first directon, respectively, and (d) correspondingly combining the first and second parts together to form the stator structure in which the bent extending portions of the first and second parts constitute a columnar portion of the stator structure for winding a coil thereon, wherein M and N are even numbers not less than four, respectively.

In accordance with one aspect of the invention, the first and second parts are integrally formed by a magnetically conductive material such as silicon steel, respectively.

Prefereably, each of the extending portions of the first and second parts is a rectangular sheet.

Preferably, each of the extending portions of the first and second parts is an arcuated sheet. The first middle portion of the first part is a ring which is connected with the each arcuated sheet of the first part through a narrowed connective portion, and the second middle portion of the second part is a ring which is connected with the each arcuated sheet of the second part through a narrowed connective portion.

After the step (d), the method further includes a step (e) of coating the columnar portion of the stator structure with an insulating material. Preferably, the insulating material is an insulating tape. In addition, after the step (e), the method further includes a step (f) of respectively bending residually unbent extending portions of the first and second parts toward the columnar portion for wrapping the coil in the stator structure.

Alternatively, the residually unbent extending portions of the first and second parts are arcuated sidewall structures such that the coil is wrapped in the stator structure by the arcuated sidewall structures of the first and second parts when the coil is wound on the columnar portion and the first and second parts are correspondingly combinated together. Preferably, the coil is a self-adhesive coil.

In accordance with another aspect of the invention, the stator structure includes a first part having a first middle portion with a through hole, and M pieces of extending portions extending from the first middle portion; a second part having a second middle portion with a through hole, and N pieces of extending portions extending from the second middle portion; wherein the M pieces of extending portions of the first part are alternately bent toward a first direction and the N pieces of extending portions of the second part are alternately bent toward a second direction opposite to the first directon, respectively, to constitute a columnar portion of the stator structure for winding a coil thereon when the first and second parts are correspondingly combined together, where M and N are even numbers not less than four, respectively.

In accordance with another yet aspect of the invention, the stator includes a first part having a first middle portion with a through hole, and M pieces of extending portions extending from the first middle portion; a second part having a second middle portion with a through hole, and N pieces of extending portions extending from the second middle portion; wherein the M pieces of extending portions of the first part are alternately bent toward a first direction and the N pieces of extending portions of the second part are alternately bent toward a second direction opposite to the first directon, respectively, to constitute

a columnar portion of the stator when the first and second parts are correspondingly combined together, where M and N are even numbers not less than four, respectively; a coil wound around the columnar portion and wrapped in the first and second parts when the residually unbent extending portions of the first and second parts are bent toward the columnar portion; and an insulator sheathed on the columnar portion for prohibiting the contact of the coil with the columnar portion.

The present invention may best be understood through the following description with reference to the accompanying drawings, in which:

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1A is an exploded view of a conventional motor fan;

Fig. 1B shows the conventional silicon steel sheet used for forming a stator of the conventional motor fan shown in Fig. 1A;

Fig. 1C shows the silicon steel sheet of Fig. 1B sheathed with an insulator;

Fig. 2 is an exploded view of the rotary device according to the present invention;

Figs. 3A~3D are schematic diagrams showing the method for forming the first preferred embodiment of the stator structure according to the present invention;

Fig. 4 is a schematic diagram showing the second preferred embodiment of the stator structure according to the present invention;

Fig. 5 is a schematic diagram showing the third preferred embodiment of the stator structure according to the present invention;

Fig. 6 is a schematic diagram showing the fourth preferred embodiment of the stator structure according to the present invention; and

Fig. 7 is a schematic diagram showing the fifth preferred embodiment of the stator structure according to the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

The present invention will now be described more detailedly with reference to the following embodiments. It is to be noted that the following descriptions of the preferred embodiments of this invention are presented herein for the purpose of illustration and description only. It is not intended to be exhaustive or to be limited to the precise form disclosed.

Please refer to Fig. 2 which is a schematic diagram showing a preferred embodiment of the method for forming a rotary device of the present invention. The rotary device 2 includes a stator 21 and a rotor 24. The stator 21 has an upper opening 211a and a lower opening (not shown) for allowing the shaft 22 supported by two bearings 23 to pass therethrough such that the rotor 24 can be coupled to the stator 21 through the shaft 800 thereby constructing the rotary device, for instance, a motor. Moreover, the rotary device further includes a printed circuit board and a base. Because the assembly of these components is not the characteristic of the present invention, the detailed descriptions are omitted.

Please refer to Figs. 3A ~ 3D showing the method for forming the first preferred embodiment of a stator structure of the present invention. The stator structure can be integrally formed by a magnetically conductive material such as silicon steel and includes a first part 211 and a second part 212, both of which are cross-shaped structures, respectively. The first part 211 is a silicon steel sheet with a central opening 211a and four extending portions 211b~211e, each of which is

a rectangular sheet radially extending out from the periphery of the central opening 211a. Likewise, the second part 212 is also a silicon steel sheet with a central opening 212a and four extending portions 212b~212e. The first and second parts constituted by the silicon steel sheets can be formed by metal punching, respectively. Two opposed extending portions 211b, 211d of the first part 211 are bent downwardly and two opposed extending portions 212c, 212e of the second part 212 are bent upwardly as shown in Fig. 3B. Then, the first and second parts are correspondingly combined together and the downwardly bent extending portions 211b, 211d of the first part 211 and the upwardly bent extending portions 212c, 212e of the second part 212 constitute the columnar portion 213 of the stator as shown in Fig. 3C, for winding the wire sheathed with the insulating material thereon to form a coil 214 as shown in Fig. 3D (Now, this constructed structure is called a bobbin), while the unbent extending portions 211c, 211e of the first part 211 are kept in the first plane and the unbent extending portions 212b, 212d of the second part 212 are kept in the second plane. Before winding the wire on the columnar portion 213 of the stator, the columnar portion 213 of the stator is preferably wound with an insulating tape (not shown). Finally, after winding the wire on the columnar portion 213 of the stator, the unbent extending portions 211c, 211e of the first part 211 and the unbent extending portions 212b, 212d of the second part 212 are bent toward the columnar portion 213, respectively, to wrap the coil 214 in the stator structure thereby forming the stator 21 shown in Fig. 2.

However, the number of the extending portions of the first and second parts is not only limited to four. The first part or the second part can have six extending portions which construct a hexagonal stellate

structure as shown in Fig. 4 (the cross-angle of any two adjacent extending portion is 60°), or can have eight extending portions which construct a octagonal stellate structure as shown in Fig. 5 (the cross-angle of any two adjacent extending portion is 45°). In addition, it can be understood that the greater the number of the extending portions of the first part or the second part of the stator structure, the more the cross section of the formed columnar portion tends to a circle.

Alternatively, as shown in Fig. 6, each extending portion of the first part or the second part of the stator structur has a crosssectionally arcuated shape so that the cross section of the columnar portion, formed after the extending portions of the first part or the second part are alternately bent upwardly or downwardly and the first and second parts are correspondingly assembled together, almost becomes a circle. In addition, as shown in Fig. 6, a narrowed connective portion 613 can be formed between each extending portion (612a, 612b, 612c, or 612d) of the first part or the second part and the central ring 611 for making the diameter of the columnar portion of the stator larger.

Additionally, the first part or the second part can also be formed as a structure shown in Fig. 7 by the cutting and punching processes. The first part 711 is completely identical to the second part 712 and each of them has a columnar portion 711b or 712b constituted by two bent and arcuated sheets, and two arcuated sidewall portions 711c or 712c. The first part 7111 has a ring 711a and the columnar portion 711b is used fro winding the coil thereon. The second part 712 also has the same structure as the first part 711. When the first part 711 and the second part 712 are correspondingly combined together, the coil 713 can be wrapped between the arcuated sidewall portions of the first and second

parts and the columnar portions of the first and second parts to form a stator 71. The coil 713 is also sheathed with the insulating material and can be a self-adhesive coil.

In conclusion, the stator structure of the present invention is integrally formed by a magnetically conductive material (e.g. silicon steel) through a punching process Furthermore, it is unnecessary to fabricate the stator through a high-temperature potting process so that the surface of the stator structure will not be damaged. By improving the defects of conventional stator, the present invention provides a stator which can be easily fabricated for providing a motor with high yield rate and high operating efficiency.

While the invention has been described in terms of what are presently considered to be the most practical and preferred embodiments, it is to be understood that the invention need not be limited to the disclosed embodiment. On the contrary, it is intended to cover various modifications and similar arrangements included within the spirit and scope of the appended claims which are to be accorded with the broadest interpretation so as to encompass all such modifications and similar structures.